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G3N
H2H
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(54) Switching illuminated displays

(57) An arrangement for controlling the switching of an array of lamps connected to a multiple-way output socket (12) includes direct earth and neutral connections and live connections to the lamps through Triacs (14) controlled by drive circuits (18).

The triacs are either switched in strict sequence according to some pattern and speed selected by switches (32, 40, 48) or in response to a control signal derived from an audio signal which is amplified and distorted according to a logarithmic scale by an audio amplifier (22) which receives the audio signal as an input.

An automatic changeover circuit, after an absence of any control signal from the amplifier (22), automatically causes the circuit to revert to a strict sequence for operating the Triac drive circuits (18) until a control signal once again appears at the output of the amplifier (22).

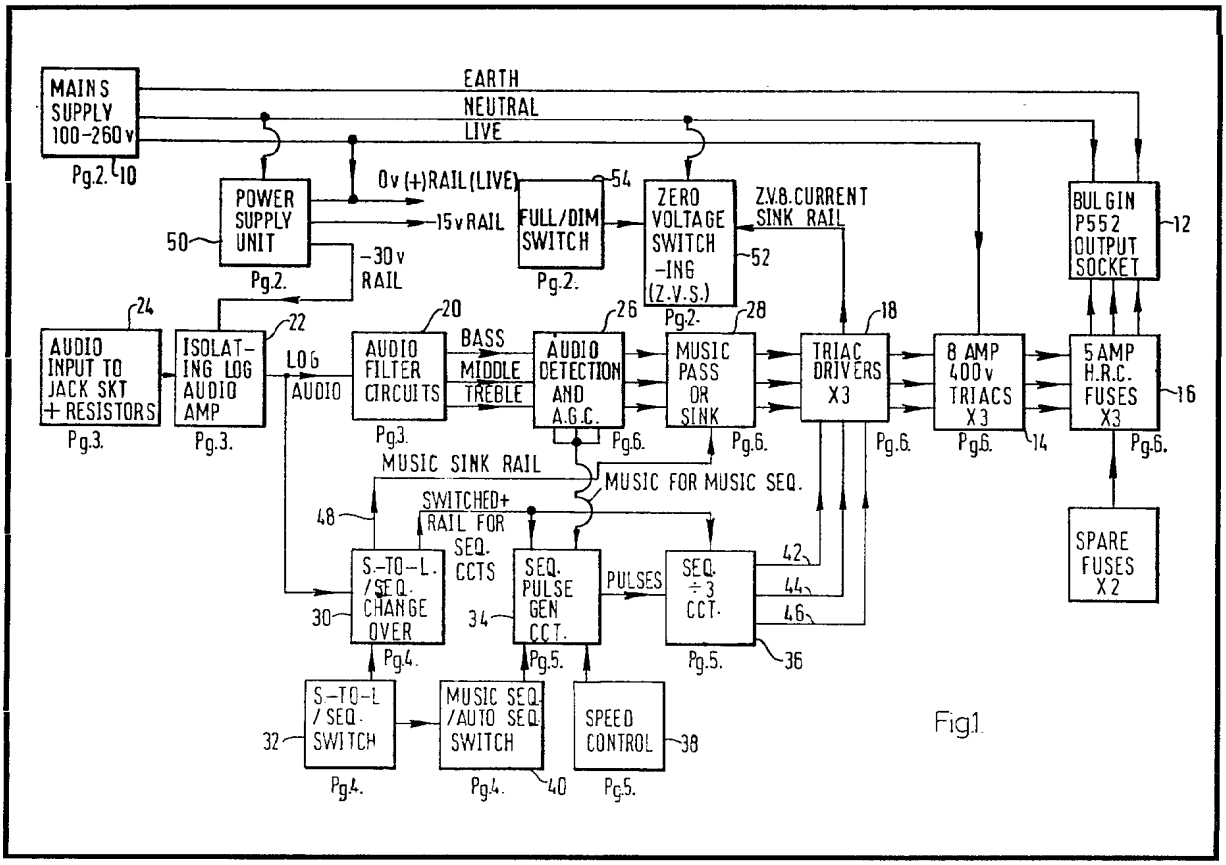

Fig1.

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

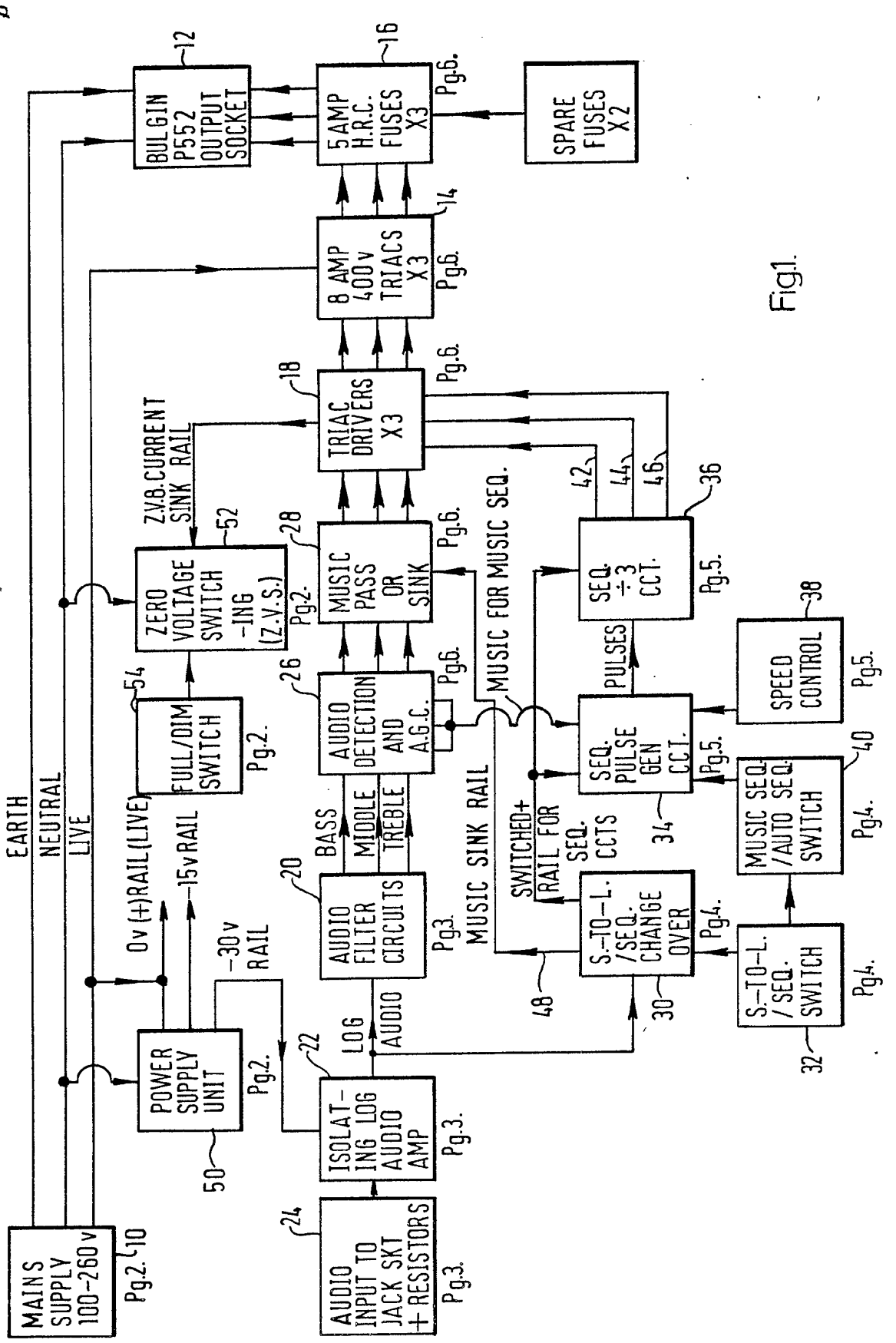
MAINS SUPPLY 100-260v
Pg.2.
10
EARTH
NEUTRAL
LIVE
POWER SUPPLY UNIT
Pg.2.
50
0v (+)RAIL (LIVE)
15v RAIL
-30v RAIL
ISOLATING LOG AUDIO AMP
Pg.3.
22
LOG AUDIO
AUDIO INPUT TO JACK SKT + RESISTORS
Pg.3.
24
AUDIO FILTER CIRCUITS
Pg.3.
20
BASS
MIDDLE
TREBLE
AUDIO DETECTION AND A.G.C.
Pg.6.
26
MUSIC PASS OR SINK
Pg.6.
28
TRIAC DRIVERS X3
Pg.6.
18
8 AMP 400v TRIACS X3
Pg.6.
14
5AMP H.R.C. FUSES X3
Pg.6.
16
BULGIN P552 OUTPUT SOCKET
12
SPARE FUSES X2
Z.V.S. CURRENT SINK RAIL
ZERO VOLTAGE SWITCHING (Z.V.S.)
Pg.2.
52
FULL/DIM SWITCH
Pg.2.
54
MUSIC FOR MUSIC SEQ.
MUSIC SINK RAIL
SEQ. ÷3 CCT.
Pg.5.
36
42
44
46
PULSES
SEQ. PULSE GEN CCT.
Pg.5.
34
SPEED CONTROL
Pg.5.
38
SWITCHED+ RAIL FOR SEQ. CCTS
48
S.-TO-L. /SEQ. CHANGE OVER
Pg.4.
30
MUSIC SEQ. /AUTO SEQ. SWITCH
Pg.4.
40
S.-TO-L. /SEQ. SWITCH
Pg.4.
32

Fig.1.

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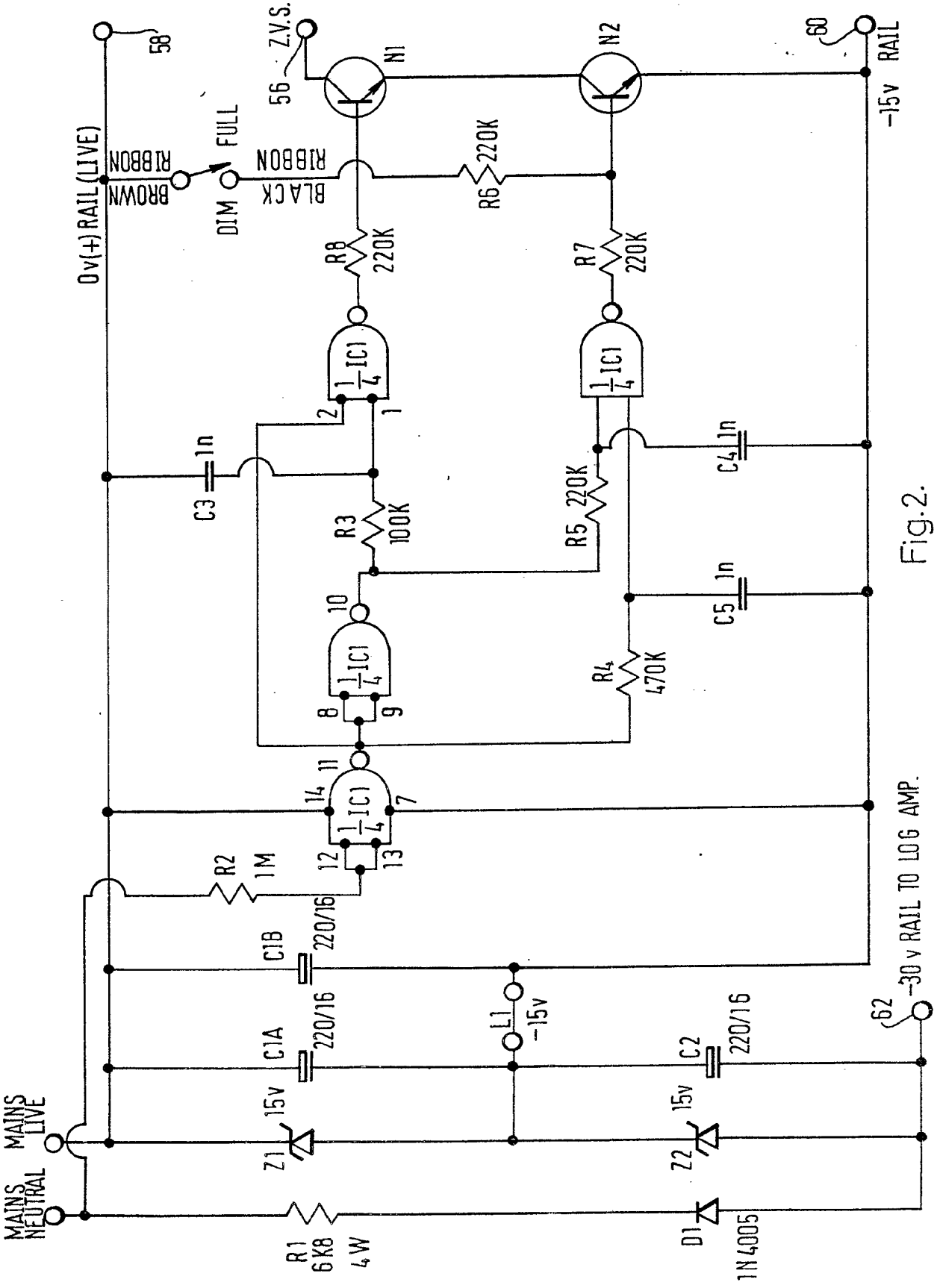


Fig.2.

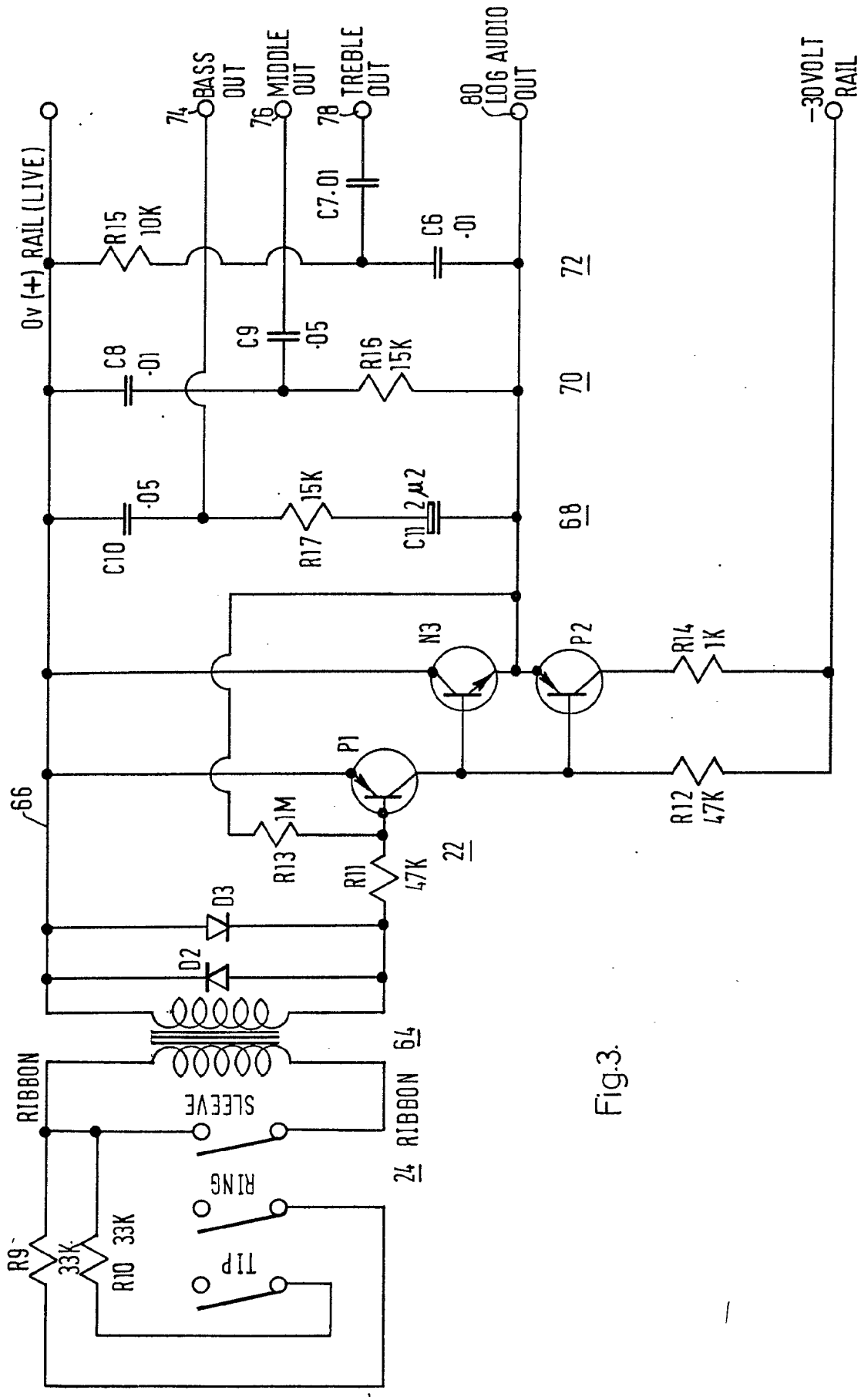

0v (+) RAIL (LIVE)
74 BASS OUT
76 MIDDLE OUT
78 TREBLE OUT
80 LOG AUDIO OUT
-30VOLT RAIL
R15 10K
C7.01
C6 .01
72
C8 .01
C9 .05
R16 15K
70
C10 .05
R17 15K
C11 2µ2
68
N3
P2
R14 1K
P1
66
R13 1M
R11 47K
22
R12 47K
D3
D2
RIBBON
SLEEVE
24 RIBBON 64
RING
TIP
R9 33K
R10 33K

Fig.3.

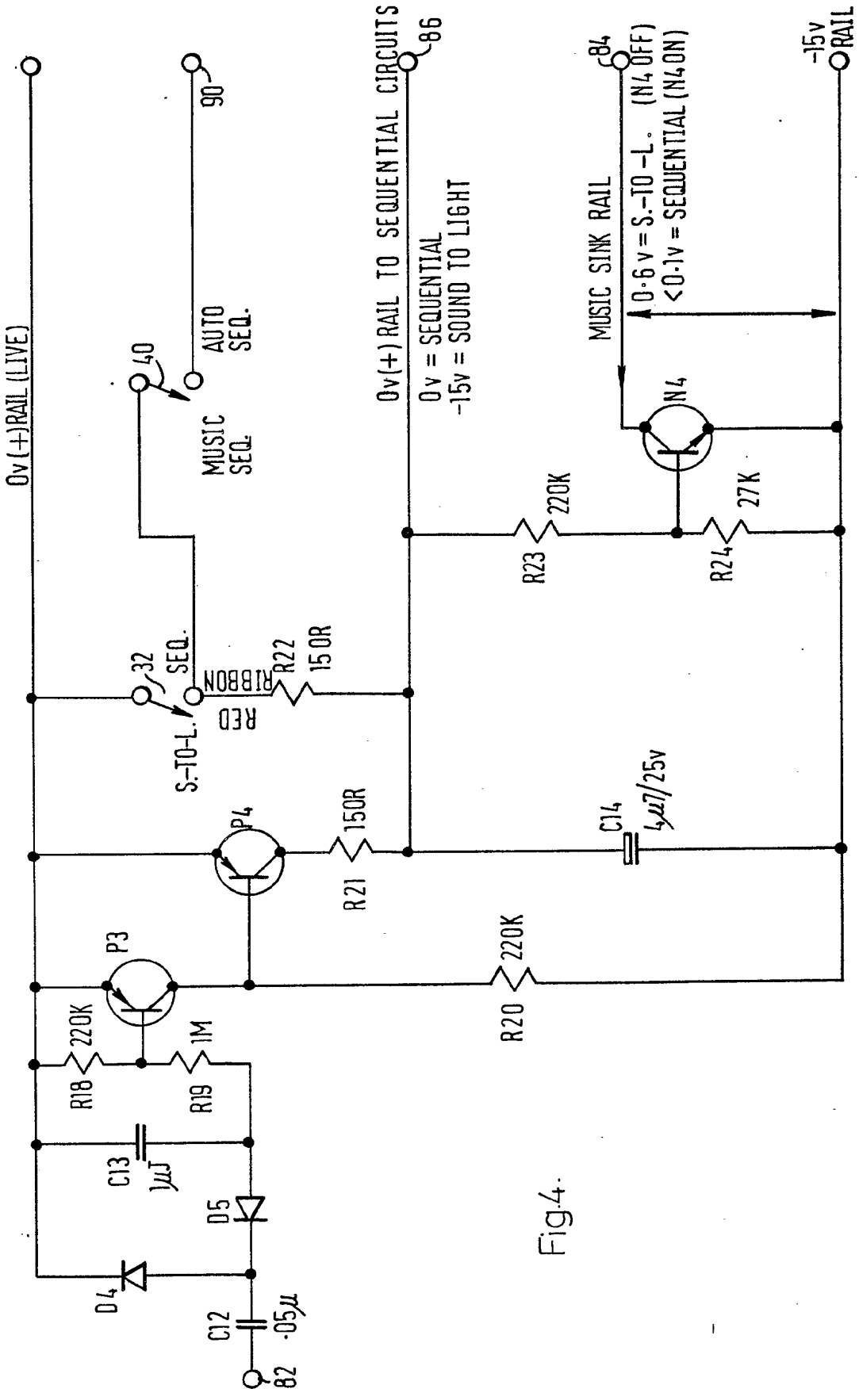

0v(+)RAIL (LIVE)
40
AUTO SEQ.
90
MUSIC SEQ.
0v(+) RAIL TO SEQUENTIAL CIRCUITS
86
0v = SEQUENTIAL
-15v = SOUND TO LIGHT
84
MUSIC SINK RAIL
0·6v = S.-TO-L. (N4 OFF)
<0·1v = SEQUENTIAL (N4 ON)
-15v RAIL
N4
R23 220K
R24 27K
32
SEQ.
S.-TO-L.
RIBBON
RED
R22 150R
P4
R21 150R
C14 4µ7/25v
P3
R20 220K
R18 220K
R19 1M
C13 1µ
D5
D4
C12 ·05µ
82

Fig.4.

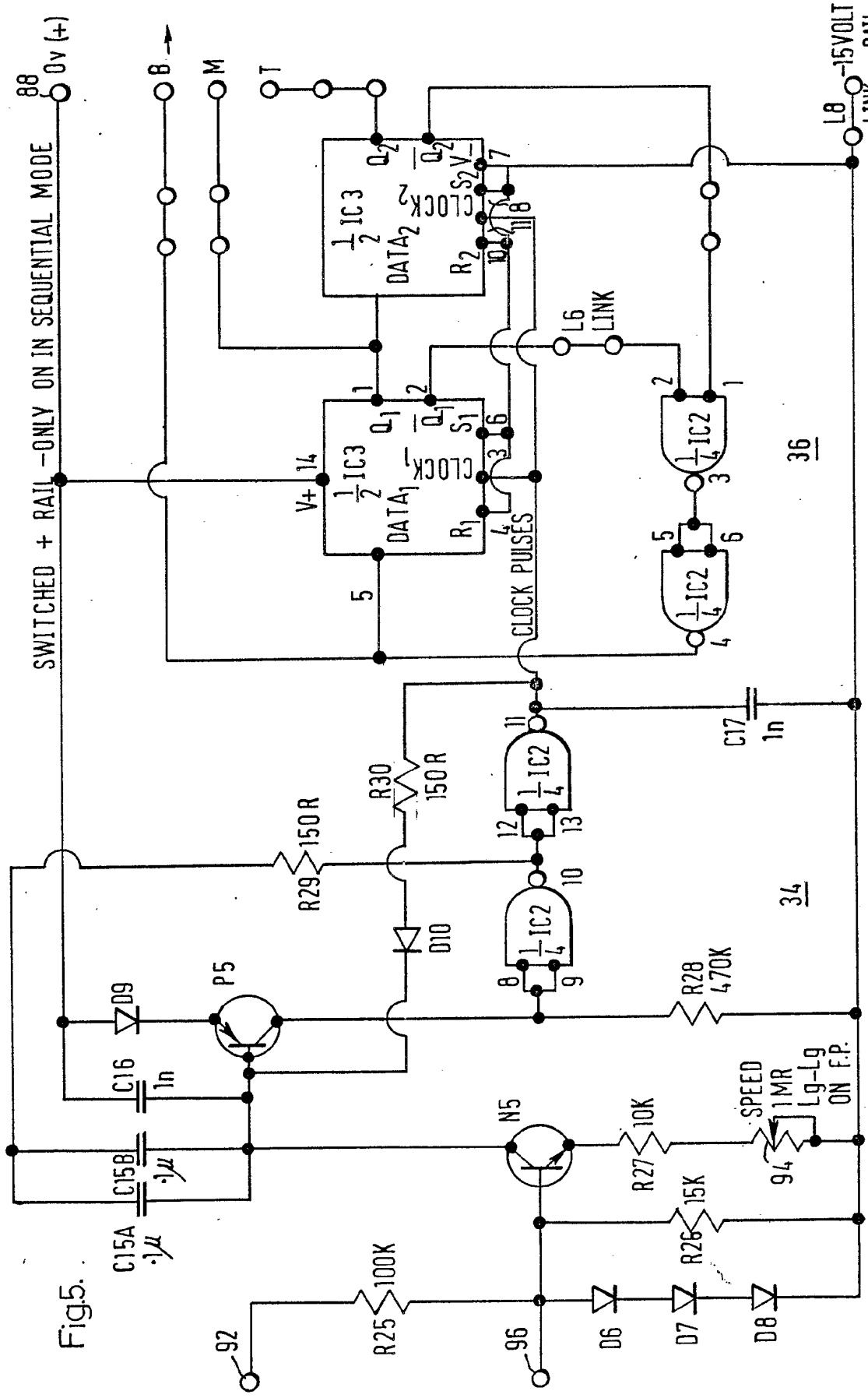

88
0v (+)
SWITCHED + RAIL -ONLY ON IN SEQUENTIAL MODE
B
M
T
L8
-15VOLT RAIL LINK
L6 LINK
CLOCK PULSES
36
34
C17 1n
C16 1n
C15B ·1μ
C15A ·1μ
R29 150 R
R30 150 R
R28 470K
R27 10K
R26 15K
R25 100K
SPEED 1MR Lg-Lg ON F.P.
P5
N5
D9
D10
D6
D7
D8
92
94
96

Fig.5.

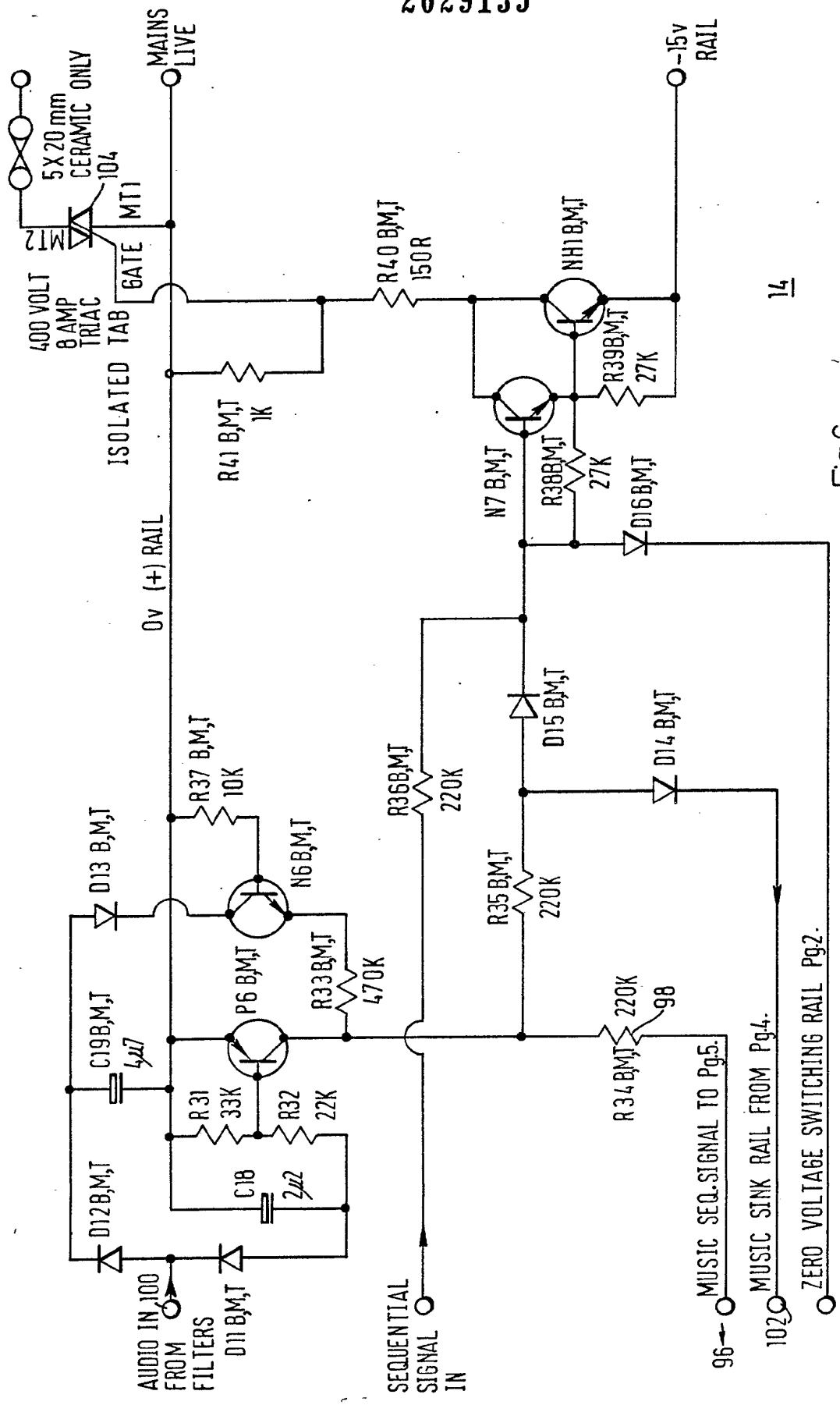

MAINS LIVE
-15v RAIL
5X20 mm CERAMIC ONLY
104
MT2
MT1
GATE
400 VOLT 8 AMP TRIAC
ISOLATED TAB
R40 B,M,T 150R
NH1 B,M,T
R39B,M,T 27K
R41 B,M,T 1K
N7 B,M,T
R38B,M,T 27K
D16B,M,T
0v (+) RAIL
R37 B,M,T 10K
D15 B,M,T
D14 B,M,T
R36B,M,T 220K
D13 B,M,T
N6 B,M,T
R35 B,M,T 220K
P6 B,M,T
R33 B,M,T 470K
C19B,M,T 4µ7
R 31 33K
R32 22K
C18 2µ2
R34 B,M,T 220K
98
D12B,M,T
D11B,M,T
AUDIO IN 100 FROM FILTERS
SEQUENTIAL SIGNAL IN
96
MUSIC SEQ.SIGNAL TO Pg5.
102
MUSIC SINK RAIL FROM Pg4.
ZERO VOLTAGE SWITCHING RAIL Pg2.

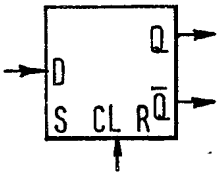
Fig.6.

4011 TRUTH TABLE

A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

4013 TRUTH TABLE

CLOCK	D	Q	$\overline{Q}$
⌐‾	1	1	0
⌐‾	0	0	1
‾⌐	1 or 0	Q	$\overline{Q}$



← NO CHANGE

Fig.7.

SPECIFICATION

Device for switching illuminated displays

Field of invention

This invention concerns a device for switching iluminated displays particularly displays of differently coloured electric lights.

Background to the invention

It is known to provide a device for sequentially switching electric lights so as to tproduce changing patterns of colour from the array of lights.

It is also known to provide a device for switching electric lights so as to produce varying patterns of colour from an array of differently coloured electric lights in dependence on the content of an electrical audio signal. The switching can be made dependent on the frequency content or the amplitude or both of the audio signal.

Devices of this type are conventionally found in discotheques and night clubs and the audio signal is usually derived either from the audio output of the record turntable or cassette recorder or from an amplifier to which signals picked up from microphones and electric guitars and other instruments played by a group, are supplied. When the music stops the amplitude excursions of the audio signal reduce to zero and the illuminated display is either cut off or remains as a stationary pattern until amplitude excursions once again occur in the audio signal.

If the gap between records or cassettes or the break between pieces from a group is to be of very short duration the break in the illumination or movement of the pattern of coloured lights is acceptable. However, more often than not the gap between records or cassettes or pieces can extend for a considerable period of time particularly where a disc jockey wishes to introduce another record or tape or the band leader wishes to introduce another piece. To fill in the gap which would otherwise occur, the disc jockey must make alternative provision and provide for sequence switching of the lights whilst the audio signal is non-existent.

It is an object of the present invention to provide a device which will automatically revert to a form of sequence switching to produce changing patterns of colour in an array of coloured lights in the event that the amplitude excursions of an audio signal supplied thereto reduce to zero.

The invention

According to the present invention a device for switching illuminated displays comprises switching means for controlling the flow of electric current to electric light bulbs arranged in an array, means for generating electrical signals for operating the said switching means in response to either an electrical signal derived from amplitude excursions of an electrical audio signal or from electrical pulses from a pulse generating circuit, the latter automatically being selected in the event that the amplitude excursions of the audio signal fall below a selected threshold.

Preferably the device includes an override switch whereby the pulses from the pulse generating circuit can be permanently supplied to control the switching means so as to produce a changing pattern or pattern of colour in the array of lights which is controlled solely by the sequence of pulses from the pulse generating circuit.

Preferably the automatic changeover circuit includes a time delay so that a given period of time has to expire between the last to be detected of the audio signal amplitude excursions and the switchover to the output from the pulse generating circuit. Typically this time delay is of the order of 2 seconds. In this way brief gaps in the train of amplitude excursions of the audio signal produced typically by breaks or pauses in the music do not trigger the transition to the output signal from the pulse generating circuit.

The invention will now be described by way of example with reference to the accompanying drawings.

In the drawings

Figure 1 is a block circuit diagram of a complete automatic changeover switching device controlling an array of lights in accordance with the invention,

Figures 2 to 6 are electric circuit diagrams of the different parts of the circuit shown in block form in Fig. 1, and

Figure 7 is a parts list for the circuits shown in the Figs. 2 to 6.

Detailed description of the drawings

Referring first of all to Fig. 1 the earth, neutral and live connections of a mains supply 10 are connected to an output socket 12 directly in the case of the earth and neutral wires and via solid state switches 14 and fuses 16 in the case of the live wire.

Electric lights (not shown) are connected to the output socket 12.

From Fig. 1 it will be seen that there are three switched live connections from the solid state

switches 14 and three fuses are provided one for each of the lines so that the socket 12 provides earth, neutral and free switched live sockets to which three different sets of lights can be connected. Either some or all or none of the lights will be operated depending on the condition of the solid state switch 14.

There are three solid state switching devices and these are in turn controlled by three driving stages generally designated 18 and in the circuit shown, one of the drivers and solid state switches is controlled by a signal derived from the base content of an amplitude varying audio signal, a second driver and solid state switch is controlled by a signal derived from mid-range content of the audio signal and a third driver and solid state switch is controlled by a signal derived from the treble content of the audio signal. The signals corresponding to the base mid-range and treble content are derived by audio filter circuit 20 to which the audio signal is supplied from an amplifier 22 having a logarithmic characteristic to which the audio signal is supplied from an input circuit 24.

The signals for controlling the driving stages 18 are derived from the base, mid-range and treble content signals by audio detection and automatic gain control circuits generally designated 26 and the output of the detection circuits 26 can be gated by solid state switching in the music pass or sink stage 28 which itself is controlled by a signal from a sound to light/sequential changeover circuit designated by reference numeral 30 and shown in more detail in Fig. 4.

The latter includes a sound to light/sequential switch 32 which controls the outputs from the changeover stage 30 and when switch 32 is put into the sequential position, the sequence pulse generator circuit 34 together with the sequence divide-by-three circuit 36 are rendered operational as are the speed control 38 and sequence select switch 40 to provide alternative control signals via lines 42, 44 and 46 to the driving stages 18 in place of the three signals from the audio detection and AGC circuits 26. The latter is prevented from supplying any signals to the driving stages 18 when the sequence pulse generating circuit 34 etc. is operational by virtue of an electrical signal on line 48 which prevents any audio derived signals from reaching the driving stages.

Operating current for the various amplifiers and solid state switching circuits etc. is obtained from a power supply unit 50 and the driving stages 18 provide zero voltage switching signals for a zero voltage switching stage 52 which includes a full/dim switch 54 for controlling the brightness of the switched lights connected to the output sockets 12.

Turning now to Fig. 2, this illustrates the power supply unit 50 and the zero voltage switching stage 52 and dim/full switch 54. The zero voltage switching control signal is applied to terminal 56 and the zero voltage and -15 volts and -30 volts bus bars are connected to terminals 58, 60 and 62 respectively.

Fig. 3 illustrates the circuit of the input jack circuit 24 and isolated logarithmic characteristic audio amplifier 22. An isolating transformer 64 separates the live rail 66 connected to the terminal 58 from the input circuit.

Typically the signal supplied to the input circuit is derived from the output stages of an audio amplifier to which the original audio signal is supplied for amplification.

The operating characteristics of the logarithmic amplifier 22 are such that large changes of input signals amplitude produce proportionately smaller changes of output signal amplitude.

Three filter circuits 68, 70 and 72 serve to separate out the base middle and treble content of the audio signal appearing in the output of the logarithmic amplifier 22 and the filter signals appear at terminal 74, 76 and 78 respectively. Terminal 80 provides an unfiltered signal for terminal 82 in Fig. 4 of the drawings.

Terminal 82 constitutes the input terminal for an automatic changeover circuit. The first part of this circuit formed from diodes D4 and D5 and capacitor C13 and resistors R18 and R19 comprises a detection circuit which produces a mean current for the base of transistor P3 when amplitude excursions of the audio signal at junction 82 are sufficient to maintain the appropriate charge in capacitor C13. In the event that the amplitude excursions in the audio signal at terminal 82 fall below a threshold value, capacitor C13 eventually becomes discharged to such an extent that P3 becomes cut off and the time lag between the occurrence of the last of the amplitude excursions and the audio signal to be detected and the turning off of transistor P3 is approximately 2 seconds and when P3 turns off P4 is turned on, base current for P4 being provided by the emitter collector junction of P3.

When transistor P4 conducts, capacitor C14 can charge up to -15 volts assuming that switch 32 is open (i.e. is in the sound to light mode). In doing so, transistor N4 is caused to conduct thereby causing the potential at terminal 84 to fall to less than 0.1 volt which effectively short circuits the signal path to the driving stages 18 shown in more detail in Fig. 6 which will be described in more detail later.

In the event that switch 32 is connected into the sequence mode, the zero volts (positive) rail is connected via R22 to terminal 86 thereby providing the necessary zero volt potential at terminal 88 in Fig. 5 so as to provide the necessary operating current for the sequential pulse

generating circuit and the divide-by-three sequence circuit 34 and 36 in Fig. 1 (the circuits being shown in more detail in Fig. 5).

Auto sequencing can be achieved by closing switch 40 with either zero audio signals or switch 32 closed into the sequence mode (or both). Closing switch 40 connects the zero volt (+) rail to terminal 90 (assuming switch 32 is closed or P4 is conducting) and this supplies a signal via terminal 92 to which terminal 90 is connected via resistor R25 to the base of transistor N5. This latter forms part of the feedback network in a pulse generating circuit generally designated 34 and the frequency of the pulses is preset by a variable resistor 94 all shown in Fig. 5.

In the event that switch 40 is open base current is provided for transistor N5 via terminal 96 which is supplied via resistor 98 (in Fig. 6) from the output of the audio detection and AGC circuits.

Fig. 6 is repeated three times for the three separate channels to provide audio detection and AGC for each of the three channels established by the audio filter circuit of Fig. 3. The circuit shown in Fig. 6 is assumed to be for the base channel and terminal 100 is therefore deemed to be connected to terminal 74 in Fig. 3.

The detection circuit formed by diodes D11 and D12 and automatic gain control circuits centred around transistors P6 and N6 produce an output signal via resistor 98 as previously described which is connected to terminal 96 in Fig. 5. The same output signal provides the operating current via resistor R35 and diode D14 for transistor N4 in Fig. 5 via terminal 102 which is deemed to be connected to terminal 84 in Fig. 4.

Diode D15 allows the detected and AGC signals to be transferred to the base circuit of transistor N7 which with transistor NH1 constitutes the driver stage for an 8-amp 400-volt Triac designated by reference numeral 104. This forms part of the solid state switching circuit 14 and is designated as such in Fig. 6.

In the event that the audio signal fails or simply comes to an end or is of insufficient amplitude, no signal appears at any of terminals 74 to 80 and after P4 (Fig. 4) conducts, the zero volt (+) rail is connected via terminal 86 to terminal 88 thus providing the necessary current for the sequential circuits of Fig. 5 and causing immediate transition to the automatic sequence mode of operation by switching on N4.

N5 is current source for charging timing capacitors C15A and C15B and the charging current for the capacitors is varied either by 94 or by varying the voltage applied to 96. The amplitude variation produced by summing the outputs from R34 (x3) from each of the three circuits of Fig. 6 produces such a varying voltage when music signal is present.

When on auto sequential R25 is connected via switch 40 to the (+ve) rail and current through R25 saturates diodes D6 to D8 and overrides any music signal to 96.

Resistors

No.	Description/Value	Pg.	Notes
R1	6K8 4W	2	Mains Dropper
R2	1M	2	Mains Sync.
R3	100K	2	2.V.S. Delay
R4	470K	2	,,
R5	220K	2	,,
R6,7,8	220K	2	,,
R9,10	33K	3	On Jack 8KT
R11,12	47K	3	Rin
R13	1M	3	Feedback
R14	1K	3	Protection
R15	10K	3	Bass Cut
R16	15K	3	
R17	15K	3	
R18	220K	4	
R19	1M	4	
R20	220K	4	
R21,22	150R	4	Protection
R23	220K	4	
R24	27K	4	
R25	100K	5	
R26	15K	5	
R27	10K	5	
R28	470K	5	
R29	150R	5	Reset I limit
R30	150R	5	
R31	33K	6	
R32	22K	6	
R33	470K	6	
R34,35,36	220K	6	
R37	10K	6	
R38,39	27K	6	
R40	150R	6	
R41	1K	6	

Capacitors

No.	Description/Value	Pg	Notes
C1A,1B	220μ 16v	2	P8U
C2	220μ 16v	2	P8U
C3,4,5	1n (.001)	2	Z.V.S. Delay
C6,7,8	10n (.01)	3	Filter CCTS
C9,10	50n (.05)	3	Filter CCTS
C11	2μ2	3	D.C. Blocking
C12	50n (.05)	4	D.C. Blocking
C13	1μJ	4	Time Constant
C14	4μ7	4	Rail Reservoir
C15A,B	0.1μ	5	Seq. Speed
C16,17	1n (.001)	5	Stability
C18	2μ2	6	Audio Smoothing
C19	4μ7	6	A.G.C. Delay

Semi Conductors

No.	Description/Value	Pg	Notes
Z1,2	15v Zener	2	400 mW
D1	IN4005	2	600 volts Rew
D2–D16	In4148,IN914	ALL	Any small Silicon
N1–N7	Silicon NPN	ALL	T0–92 Package. E.B.C. Lead Order. Vceo>30v NFE>100 at 2 mg
P1–P6	Silicon PNP	ALL	ditto
NH1	Silicon NPN	6	Ditto but HFE>100 at 100mg
Triacs	8 amp 400 volt		T0 220 Isolated Tab.
IC1,2	4011	2,5	CMOS Quad NAND Gate
IC3	4013	5	CMOS Dual D Type Flip-flop

CLAIMS

1. A device for switching illuminated displays comprising: switching means for controlling the flow of electric current to electric light bulbs arranged in an array, means for generating electrical signals for operating the said switching means in response to either an electrical signal derived from amplitude excursions of an electrical audio signal or from electrical pulses from a pulse generating circuit, the latter automatically being selected in the event that the amplitude excursions of the audio signal fall below a selected threshold.

2. A device as claimed in claim 1 which includes an override switch whereby the pulses from the pulse generating circuit can be permanently supplied to control the switching means so as to produce a changing pattern or pattern of colour in the array of lights which is controlled solely by the sequence of pulses from the pulse generating circuit.

3. A device as claimed in claim 1 or 2 in which the automatic changeover circuit includes a time delay so that a given period of time has to expire between the last to be detected of the audio signal amplitude excursions and the switchover to the output from the pulse generating circuit.

4. A device as claimed in claim 3 in which the time delay is of the order of 2 seconds.

5. A device as claimed in claim 1 constructed and arranged substantially as herein described with reference to and as illustrated in the accompanying drawings.

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